MORNSUN®

# VRA_LD-20WR2 & VRB_LD-20WR2 SERIES

## 20W,*WIDE INPUT, ISOLATED & REGULATED DUAL/SINGLE OUTPUT DC-DC CONVERTER*

Patent Protection RoHS

### FEATURES

- Efficiency up to 90%
- 2:1 wide input voltage range
- Low temperature rise
- Short circuit protection
- 1.5KVDC isolation
- Operating temperature range: -40°C ~ +85°C
- Six-sided metal shield
- Industry standard pinout
- Industrial level specifications
- Meet CISPR22/EN55022 CLASS A

### PART NUMBER SYSTEM

VRB2405LD-20WR2

- Rated Power
- Package Style
- Output Voltage
- Input Voltage
- Product Series

### APPLICATION

VRA_LD-20WR2 & VRB_LD-20WR2 series are applied to wide voltage range input situation such as data transmission device、battery power supply device、telecommunication device、distributed power supply system、remote control system、industrial robot system etc.

### SELECTION GUIDE

| Model Number | Input Voltage(VDC) | | Output Voltage (VDC) | Output Current (mA) | | Input Current (mA)(typ.) | | Reflected Ripple Current (mA,typ.) | Max. Capacitive Load# (μF) | Efficiency (%, typ.) @Max. Load |
|---|---|---|---|---|---|---|---|---|---|---|
| | Nominal (Range) | Max** | | Max. | Min. | @Max. Load | @No Load | | | |
| *VRA1205LD-20WR2 | 12 (9-18) | 20 | ±5 | ±2000 | ±100 | 1938 | 30 | 30 | 4800 | 86 |
| *VRA1212LD-20WR2 | | | ±12 | ±834 | ±42 | 1895 | 25 | | 800 | 88 |
| *VRA1215LD-20WR2 | | | ±15 | ±667 | ±33 | 1895 | 25 | | 500 | 88 |
| *VRA1224LD-20WR2 | | | ±24 | ±417 | ±21 | 1895 | 20 | | 300 | 88 |
| *VRB1203LD-20WR2 | | | 3.3 | 5000 | 250 | 1600 | 65 | | 18700 | 86 |
| *VRB1205LD-20WR2 | | | 5 | 4000 | 200 | 1872 | 60 | | 9600 | 89 |
| *VRB1212LD-20WR2 | | | 12 | 1667 | 84 | 1872 | 25 | | 1600 | 89 |
| *VRB1215LD-20WR2 | | | 15 | 1333 | 67 | 1872 | 25 | | 1000 | 89 |
| *VRB1224LD-20WR2 | | | 24 | 834 | 42 | 1853 | 30 | | 470 | 90 |
| *VRA2405LD-20WR2 | 24 (18-36) | 40 | ±5 | ±2000 | ±100 | 969 | 25 | | 4800 | 86 |
| *VRA2412LD-20WR2 | | | ±12 | ±834 | ±42 | 948 | 20 | | 800 | 88 |
| *VRA2415LD-20WR2 | | | ±15 | ±667 | ±34 | 948 | 20 | | 500 | 88 |
| *VRA2424LD-20WR2 | | | ±24 | ±417 | ±21 | 948 | 20 | | 300 | 88 |
| VRB2403LD-20WR2 | | | 3.3 | 5000 | 250 | 800 | 40 | | 18700 | 86 |
| VRB2405LD-20WR2 | | | 5 | 4000 | 200 | 926 | 40 | | 9600 | 90 |
| VRB2412LD-20WR2 | | | 12 | 1667 | 84 | 937 | 20 | | 1600 | 89 |
| VRB2415LD-20WR2 | | | 15 | 1333 | 67 | 926 | 20 | | 1000 | 90 |
| VRB2424LD-20WR2 | | | 24 | 834 | 42 | 916 | 20 | | 470 | 91 |
| *VRA4805LD-20WR2 | 48 (36-75) | 80 | ±5 | ±2000 | ±100 | 484 | 20 | | 4800 | 86 |
| *VRA4812LD-20WR2 | | | ±12 | ±834 | ±42 | 474 | 15 | | 800 | 88 |
| *VRA4815LD-20WR2 | | | ±15 | ±667 | ±34 | 468 | 15 | | 500 | 89 |
| *VRA4824LD-20WR2 | | | ±24 | ±417 | ±21 | 468 | 15 | | 300 | 89 |
| VRB4803LD-20WR2 | | | 3.3 | 5000 | 250 | 400 | 25 | | 18700 | 86 |
| VRB4805LD-20WR2 | | | 5 | 4000 | 200 | 463 | 25 | | 9600 | 90 |
| VRB4812LD-20WR2 | | | 12 | 1667 | 84 | 469 | 10 | | 1600 | 89 |
| VRB4815LD-20WR2 | | | 15 | 1333 | 67 | 463 | 10 | | 1000 | 90 |
| *VRB4824LD-20WR2 | | | 24 | 834 | 42 | 468 | 10 | | 470 | 89 |

Note:1. *Designing. **Input voltage can't exceed this value, or will cause the permanent damage.
2. # For each output.
3.Add suffix "H" for heat sink mounted, for example VRA2405LD-20WHR2.

## INPUT SPECIFICATIONS

| Item | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Input Surge Voltage (1sec.max.) | 12VDC input | -- | -- | 25 | VDC |
| | 24VDC input | -- | -- | 50 | |
| | 48VDC input | -- | -- | 100 | |
| Start-up Voltage | 12VDC input | -- | -- | 9 | |
| | 24VDC input | -- | -- | 17.8 | |
| | 48VDC input | -- | -- | 35.8 | |
| Under Voltage Shutdown | 12VDC input | 7.5 | -- | -- | |
| | 24VDC input | 16 | -- | -- | |
| | 48VDC input | 32 | -- | -- | |
| Start-up Time | Nominal input& constant resistance load | -- | 10 | -- | ms |
| Ctrl* | Models ON | Ctrl open or connect TTL high level (2.5-12VDC) | | | |
| | Models OFF | Ctrl connect GND or low level (0-1.2VDC) | | | |
| | Input current (Models OFF) | -- | 1 | -- | mA |
| Input Filter | | π Filter | | | |

Note: *The CTRL control pin voltage is refer to GND.

## OUTPUT SPECIFICATIONS

| Item | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Output Power | | 1 | -- | 20 | W |
| Positive Voltage Accuracy | Refer to recommended circuit | -- | ±1 | ±3 | % |
| Negative Voltage Accuracy | | | | | |
| Output Voltage Balance | Dual output, balanced loads | -- | ±0.5 | ±1 | |
| Line Regulation | Full load, input voltage from low to high | -- | ±0.2 | ±0.5 | |
| Load Regulation | 10% to 100% load | -- | ±0.5 | ±1 | |
| Cross Regulation | Dual output, main output 50% load, Supplement output from 10% to 100% load | -- | -- | ±5 | |
| Transient Recovery Time | 25% load step change | -- | 300 | 500 | μs |
| Transient Response Deviation | | -- | ±3 | ±5 | % |
| Temperature Drift | Full load | -- | ±0.02 | -- | %/°C |
| Ripple & Noise* | 20MHz bandwidth | -- | 70 | 100 | mVp-p |
| Trim | | -- | ±10% | -- | VDC |
| Output Over Voltage Protection | 3.3VDC output | -- | 3.9 | -- | |
| | 5VDC output | -- | 6.2 | -- | |
| | 12VDC output | -- | 15 | -- | |
| | 15VDC output | -- | 18 | -- | |
| | 24VDC output | -- | 30 | -- | |
| Over Current Protection | Input voltage range | -- | 150 | -- | % |
| Short Circuit Protection | | Hiccup, Continuous, automatic recovery | | | |

Note: * Ripple and noise tested by “parallel cable” method. See detailed operation instructions at Testing of Power Converter section, application notes.

## COMMON SPECIFICATIONS

| Item | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Isolation Voltage | Tested for 1 minute and leakage current less than 1 mA | 1500 | -- | -- | VDC |
| Isolation Resistance | Test at 500VDC | 1000 | -- | -- | MΩ |
| Isolation Capacitance | Input/Output,100KHz/0.1V | -- | 1000 | -- | pF |
| Switching Frequency | | -- | 300 | -- | KHz |
| MTBF | MIL-HDBK-217F@25℃ | 1000 | -- | -- | K hours |
| Case Material | | Aluminum Alloy | | | |
| Weight | Without heatsink | -- | 28 | -- | g |
| | With heatsink | -- | 36 | -- | |

## ENVIRONMENTAL SPECIFICATIONS

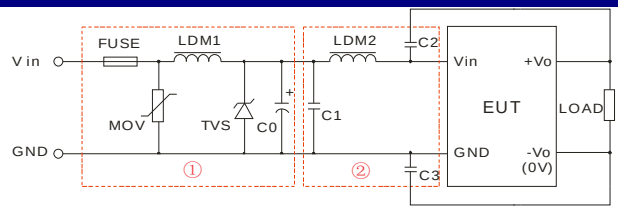
| Item | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Storage Humidity | Non condensing | 5 | -- | 95 | % |
| Operating Temperature | See Temperature Derating Curve | -40 | -- | 85 | °C |

| | | | | | |
|---|---|---|---|---|---|
| Storage Temperature | | -55 | -- | 125 | °C |
| The Max. Case Temperature | Operating Temperature curve range | -- | -- | 105 | |
| Lead Temperature | 1.5mm from case for 10 seconds | -- | -- | 300 | |
| Cooling | | Free air convection | | | |
| Shake | | 10-55Hz, 10G, 30 Min. along X, Y and Z | | | |

## EMC SPECIFICATIONS

| | | | | |
|---|---|---|---|---|
| EMI | CE | CISPR22/EN55022 | CLASS A（Without External Circuit）/ CLASS B（External Circuit Refer to Figure1-②） | |
| | RE | CISPR22/EN55022 | CLASS A（Without External Circuit）/ CLASS B（External Circuit Refer to Figure1-②） | |
| EMS | ESD | IEC/EN61000-4-2 | Contact ±4KV | perf. Criteria B |
| | RS | IEC/EN61000-4-3 | 10V/m | perf. Criteria A |
| | EFT | IEC/EN61000-4-4 | ±2KV | perf. Criteria B（External Circuit Refer to Figure1-①） |
| | Surge | IEC/EN61000-4-5 | ±2KV | perf. Criteria B（External Circuit Refer to Figure1-①） |
| | CS | IEC/EN61000-4-6 | 3 Vr.m.s | perf. Criteria A |
| | Voltage dips、short and interruptions immunity | IEC/EN61000-4-29 | 0%-70% | perf. Criteria B |

## EMC RECOMMENDED CIRCUIT



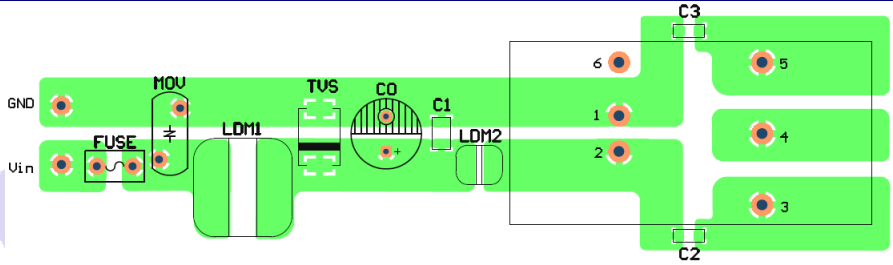

(Figure1)

Note: 1. In Figure 1,part①is EMS Recommended external circuit, part②is EMI recommended external circuit. Choose according to requirements.
2. If there is no recommended parameters, the model no require the external component.

Recommended external circuit parameters:

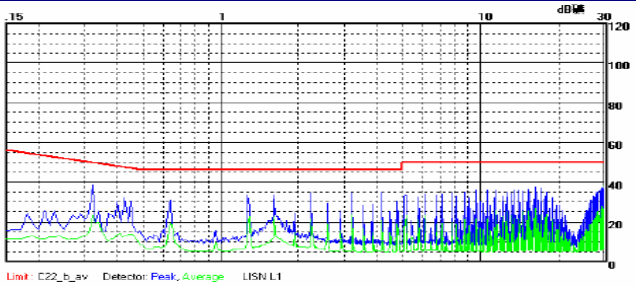
| Model | Vin:12V | Vin:24V | Vin:48V |
|---|---|---|---|
| FUSE | Choose according to practical input current | | |
| MOV | -- | 10D560 | 10D101 |
| LDM1 | -- | 56μH | |
| TVS | SMCJ28A | SMCJ48A | SMCJ90A |
| C0 | 680μF/25V | 120μF/50V | 120μF/100V |
| C1 | 1μF /50V | 1μF /50V | 1μF /100V |
| LDM2 | 4.7μH | | |
| C2、C3 | 1nF/2KV | | |

## EMC RECOMMENDED CIRCUIT PCB LAYOUT

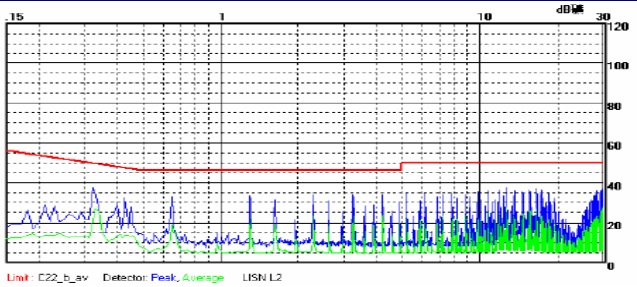



(Figure 2)

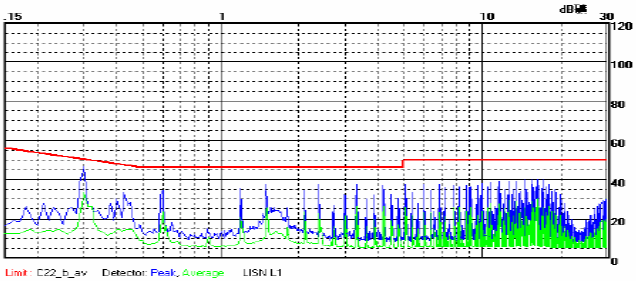
## EMC TEST WAVEFORM(CLASS B APPLY CIRCUIT)



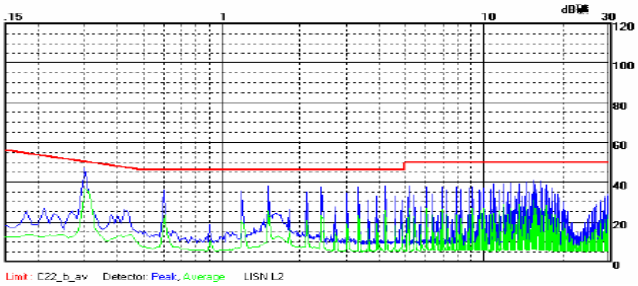
VRA2405LD-20WR2 CE (Positive line)



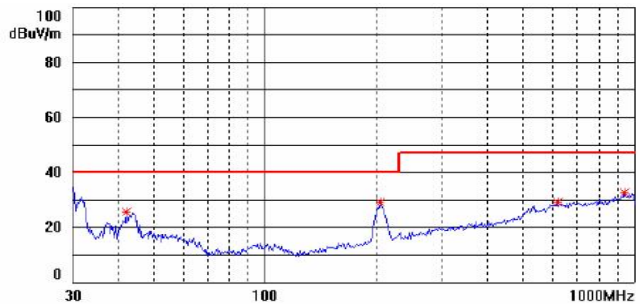
VRA2405LD-20WR2 CE (Negative line)



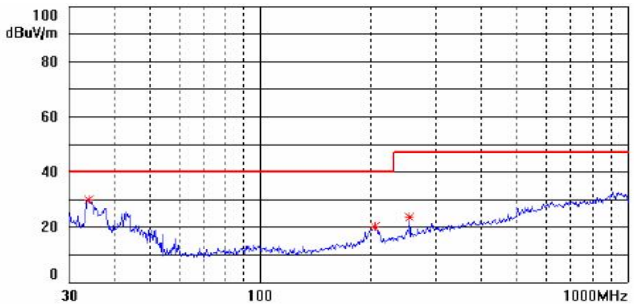
VRA4815LD-20WR2 CE (Positive line)



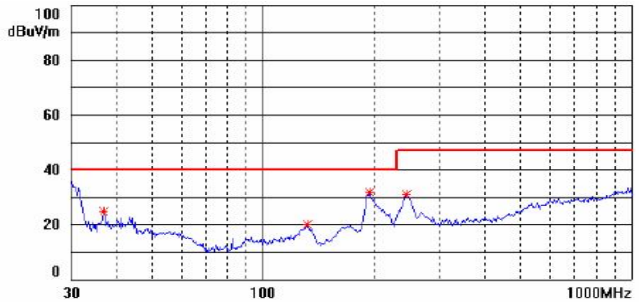
VRA4815LD-20WR2 CE (Negative line)



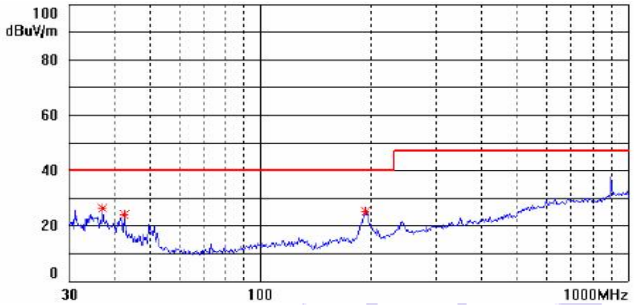

VRA2405LD-20WR2 RE(Horizontal)



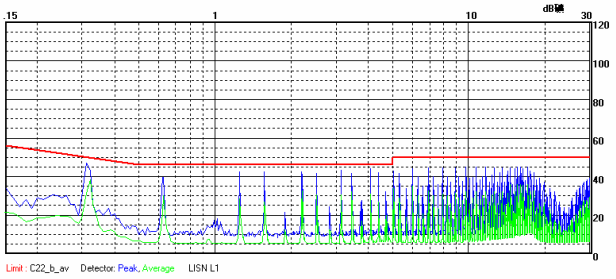

VRA2405LD-20WR2 RE(Vertical)



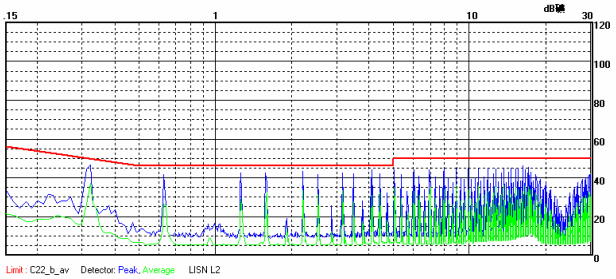

VRA4815LD-20WR2 RE(Horizontal)



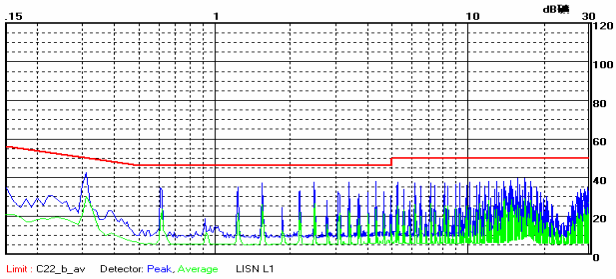

VRA4815LD-20WR2 RE(Vertical)



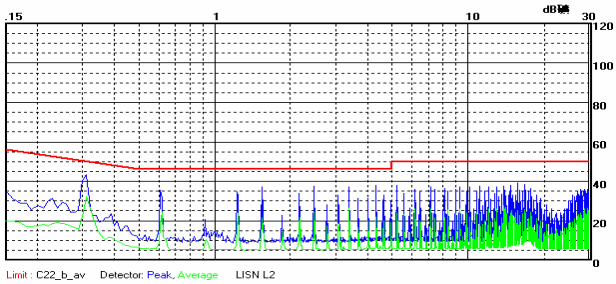

VRB2405LD-20WR2 CE (Positive line)



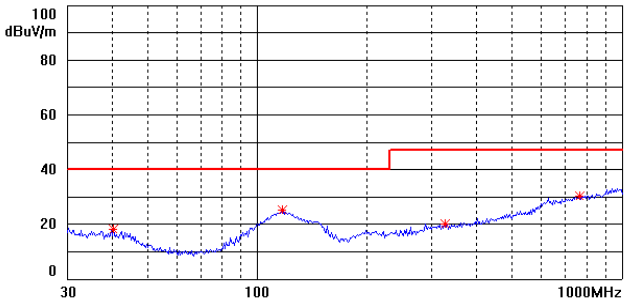

VRB2405LD-20WR2 CE (Negative line)



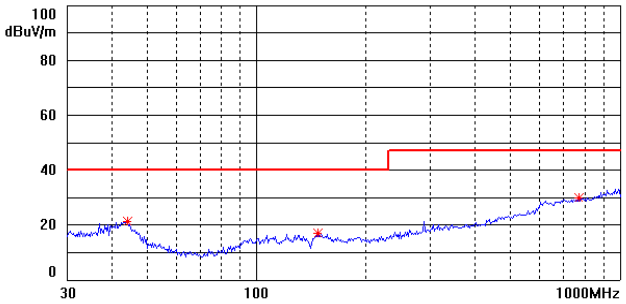

VRB4815LD-20WR2 CE (Positive line)



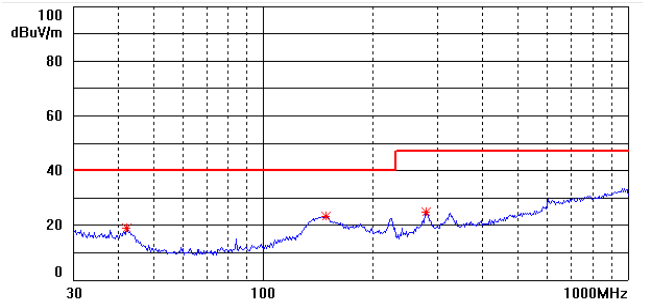

VRB4815LD-20WR2 CE (Negative line)



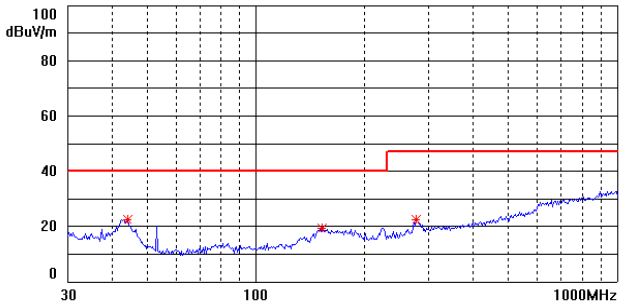

VRB2405LD-20WR2 RE(Horizontal)




VRB2405LD-20WR2 RE(Vertical)



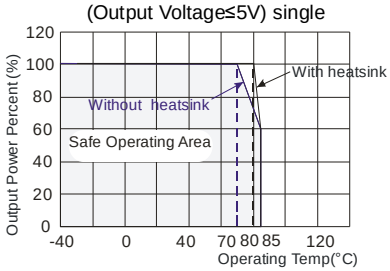
VRB4815LD-20WR2 RE(Horizontal)



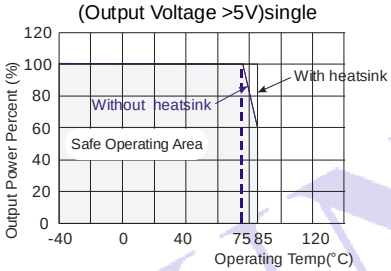
VRB4815LD-20WR2 RE(Vertical)

## PRODUCT TYPICAL CURVE

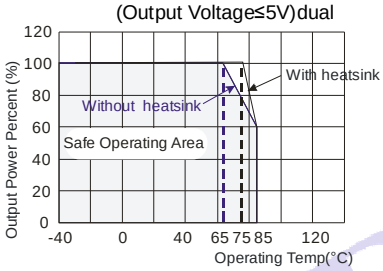
(Output Voltage≤5V) single



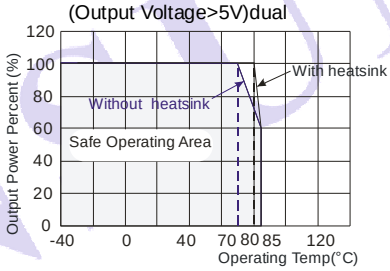

(Output Voltage >5V)single



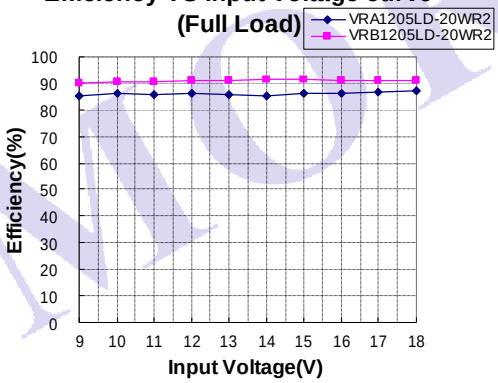

(Output Voltage≤5V)dual



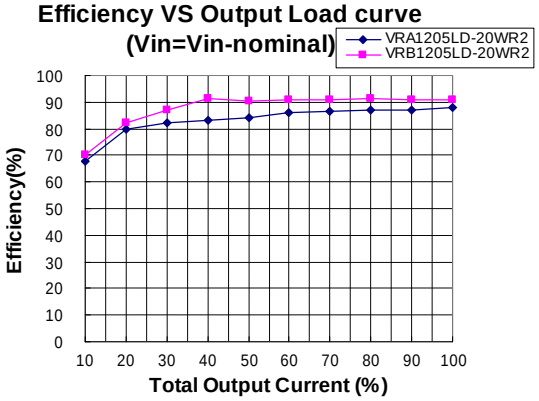

(Output Voltage>5V)dual



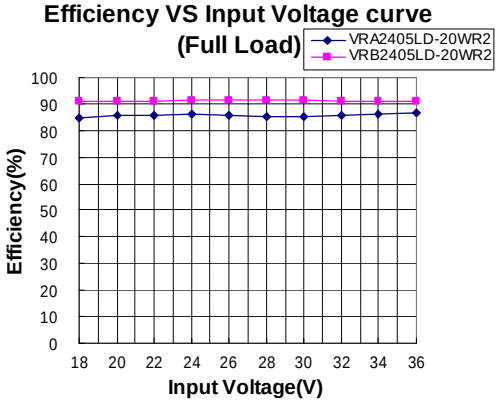

Efficiency VS Input Voltage curve
(Full Load)



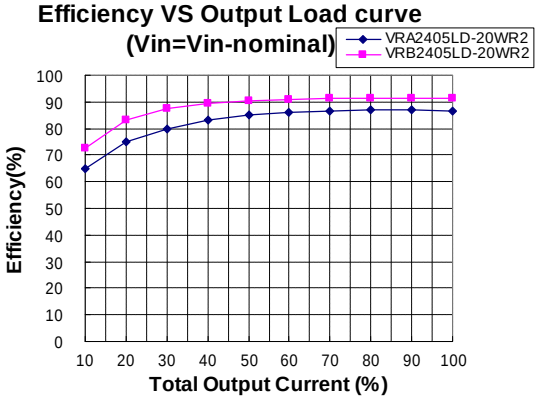

Efficiency VS Output Load curve
(Vin=Vin-nominal)




Efficiency VS Input Voltage curve
(Full Load)

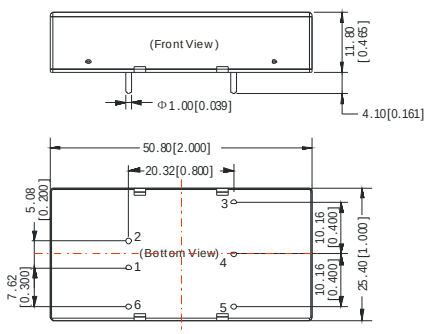



Efficiency VS Output Load curve
(Vin=Vin-nominal)



## OUTLINE DIMENSIONS, RECOMMENDED FOOTPRINT & PACKAGING

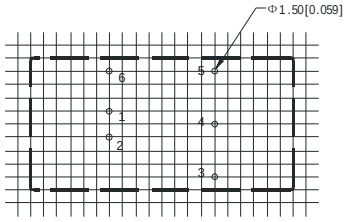
### MECHANICAL DIMENSIONS




| FOOTPRINT DETAILS | | |
|---|---|---|
| Pin | SINGLE | DUAL |
| 1 | GND | GND |
| 2 | Vin | Vin |
| 3 | +Vo | +Vo |
| 4 | Trim | 0V |
| 5 | 0V | -Vo |
| 6 | Ctrl | Ctrl |

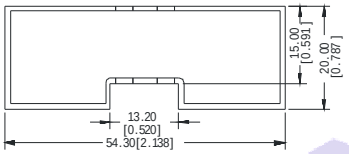
Note:
Unit:mm[inch]
Pin diameter tolerances: ±0.10mm[ ±0.004inch]
Pin height tolerances: ±0.50mm[ ±0.020inch]
General tolerances: ±0.30mm[ ±0.012inch]

### RECOMMENDED FOOTPRINT



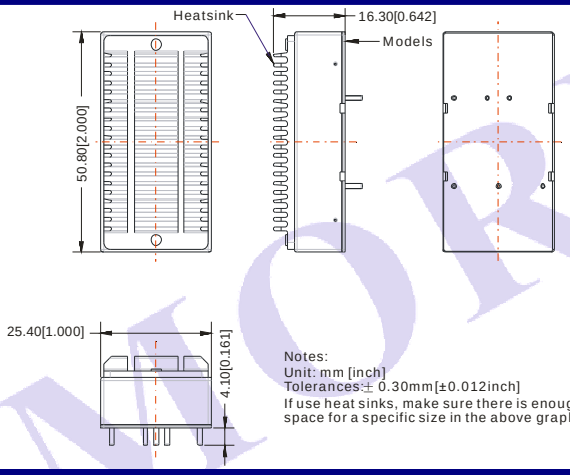

Note: grid 2.54*2.54mm

### TUBE OUTLINE DIMENSIONS(WITHOUT HEATSINK)



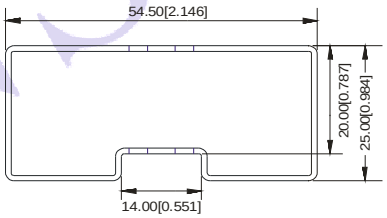

Unit :mm[inch]
General tolerances: ±0.50mm[ ±0.020inch]
L=220mm[8.661inch] Pcs/Tube:7
Inner package dimensions: L*W*H= 255*170*80mm
Outer package dimensions(with six inner packaging boxes):
L*W*H= 375*280*270mm

## HEATSINK ASSEMBLY




Notes:
Unit: mm [inch]
Tolerances:± 0.30mm[±0.012inch]
If use heat sinks, make sure there is enough space for a specific size in the above graph.

## TUBE OUTLINE DIMENSIONS (WITH HEATSINK)

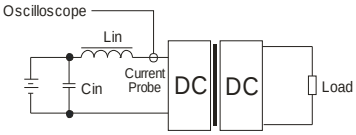



Unit :mm[inch]
General tolerances: ± 0.50mm[± 0.020inch]
L=220mm[8.661inch] Pcs/Tube:7
Inner package dimensions: L*W*H= 255*170*80mm
Outer package dimensions(with six inner packaging boxes)
L*W*H= 375*280*270mm

## TEST CONFIGURATIONS

**Input Reflected-Ripple Current Test Setup**

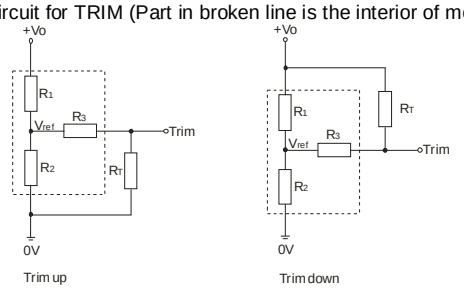
Input reflected-ripple current is measured with an inductor Lin and Capacitor Cin to simulate source impedance.




Lin(4.7μH) Cin(220μF, ESR < 1.0Ω at 100 KHz)

## TRIM APPLICATION & TRIM RESISTANCE

Application circuit for TRIM (Part in broken line is the interior of models)




Formula for resistance of TRIM

$$\text{up: } R_T = \frac{aR_2}{R_2 - a} - R_3 \qquad a = \frac{Vref}{Vo' - Vref} \cdot R_1$$

$$\text{down: } R_T = \frac{aR_1}{R_1 - a} - R_3 \qquad a = \frac{Vo' - Vref}{Vref} \cdot R_2$$

Note: Leave open if not used. Value for R1, R2, R3, and Vref refer to the above table 1. $R_T$: Resistance of Trim. a: User-defined parameter, no actual meanings. Vo': The trim up/down voltage.

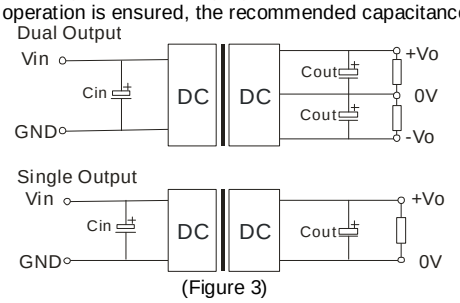
(Table 1)

| Parameter \ Vo | 3.3(VDC) | 5(VDC) | 12(VDC) | 15(VDC) | 24 (VDC) |
|---|---|---|---|---|---|
| R1(KΩ) | 4.801 | 2.883 | 10.971 | 14.497 | 24.872 |
| R2(KΩ) | 2.863 | 2.864 | 2.864 | 2.864 | 2.863 |
| R3(KΩ) | 15 | 10 | 17.8 | 17.8 | 20 |
| Vref(V) | 1.24 | 2.5 | 2.5 | 2.5 | 2.5 |

## RECOMMENDED CIRCUIT

If you want to further decrease the input surge voltage and the output ripple etc, an capacitor filtering network may be connected to the input and output ends of the DC/DC converter, see (Figure 3).

It should also be noted that the capacitance of filter capacitor must be proper. If the capacitance is too big, a startup problem might arise. For every channel of output, provided the safe and reliable operation is ensured, the recommended capacitance of its filter capacitor sees (Table 2).




(Figure 3)

EXTERNAL CAPACITOR TABLE (Table 2)

| Single Vout (VDC) | Cout (μF) | Cin (μF) | Dual Vout (VDC) | Cout# (μF) | Cin (μF) |
|---|---|---|---|---|---|
| 3.3/5 | 470 | 100 | ±5 | 220 | 100 |
| 12/15 | 220 | | ±12/±15 | 100 | |
| 24 | 100 | | ±24 | 47 | |

Note: # For each output.

**Cannot use in parallel and hot swap**

Note:
1. Input voltage can't exceed this value, or will cause the permanent damage.
2. Min. load shouldn't be less than 5%, otherwise ripple maybe increase dramatically. Operation under minimum load will not damage the converter, however, they may not meet all specification listed.
3. Max. Capacitive Load tested at nominal input voltage and constant resistive load .
4. All specifications measured at Ta=25°C, humidity<75%, nominal input voltage and rated output load unless otherwise specified.
5. In this datasheet, all the test methods of indications are based on our corporate standards.
6. All characteristics are for listed model, non-standard models may perform differently, please contact our technical person for more detail.
7. Contact us for your specific requirement.
8. Specifications subject to change without prior notice.

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